

Contact Stress Design Parameters for Titanium Bearings, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

Air-Lock's Phase I effort tested the effects of ball induced contact stresses on Titanium bearing races. The contact stress design limit that would achieve a planetary exploration suit's required cycle life was determined. These tests were performed on uniformly loaded flat thrust bearing style test plates. The Phase II effort will take this information and use it in a real world application, existing advanced planetary exploration suit's bearings. Specifically focusing on the Z-1 series suit's Hip and Waist, and also the Z-2 Series Hip bearings. These are areas that are known to have large contact stresses due to non-uniform loading through axial restraint lines. This loading yields increased stresses in different areas of the race. With an understanding of the max expected stress, the bearing design can be made to accommodate all contact stresses applied to the race. The Phase II effort will consist of finding the maximum expected contact stresses in these bearings through both test and FEA simulation. The bearing designs can then be optimized to reduce the contact stresses in these areas. Air-Lock will manufacture DVT units in order to cycle test the optimized bearings. The task will be finalized with the delivery of optimized bearings capable of being used on the Z-1 Series and Z-2 Series suits.

ANTICIPATED BENEFITS

To NASA funded missions:

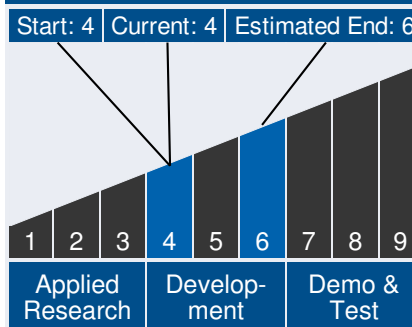
Potential NASA Commercial Applications: Air-Lock's core business focuses on providing life support hardware to enhance human performance in hazardous environments. The Titanium bearing design knowledge learned through test and simulation will be used on all suit projects moving forward. Titanium is an excellent candidate bearing race material. It offers lighter weight compared to Stainless Steels commonly used in EVA applications. It offers higher strength Aluminums commonly used in IVA applications. As ever-present budgetary restraints



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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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move the industry towards **one suit fits all applications** approaches. The knowledge and design techniques learned through these efforts will be used in support of all existing and future suit efforts including the current space suit program of record (EMU) and future programs (OCSS and AES) to market the Titanium bearing technology.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Along with servicing the space industry, Air-Lock provides this life support hardware to the aerospace, military and fire fighter industries. Similar to our spacesuit products, weight reduction and low profiles are design drivers for aerospace, military and fire fighter life support hardware. A key staple of core products for those industries are quick disconnects (QDs) that utilize bearing ball locking mechanisms. Understanding the role ball contact stresses play relative to component wear and degradation can be implemented across these QD product lines; yielding lighter weight, improved wear resistant assemblies.

Management Team (*cont.*)

Principal Investigator:

- Brian Battisti

Technology Areas

Primary Technology Area:

Human Health, Life Support, and Habitation Systems (TA 6)

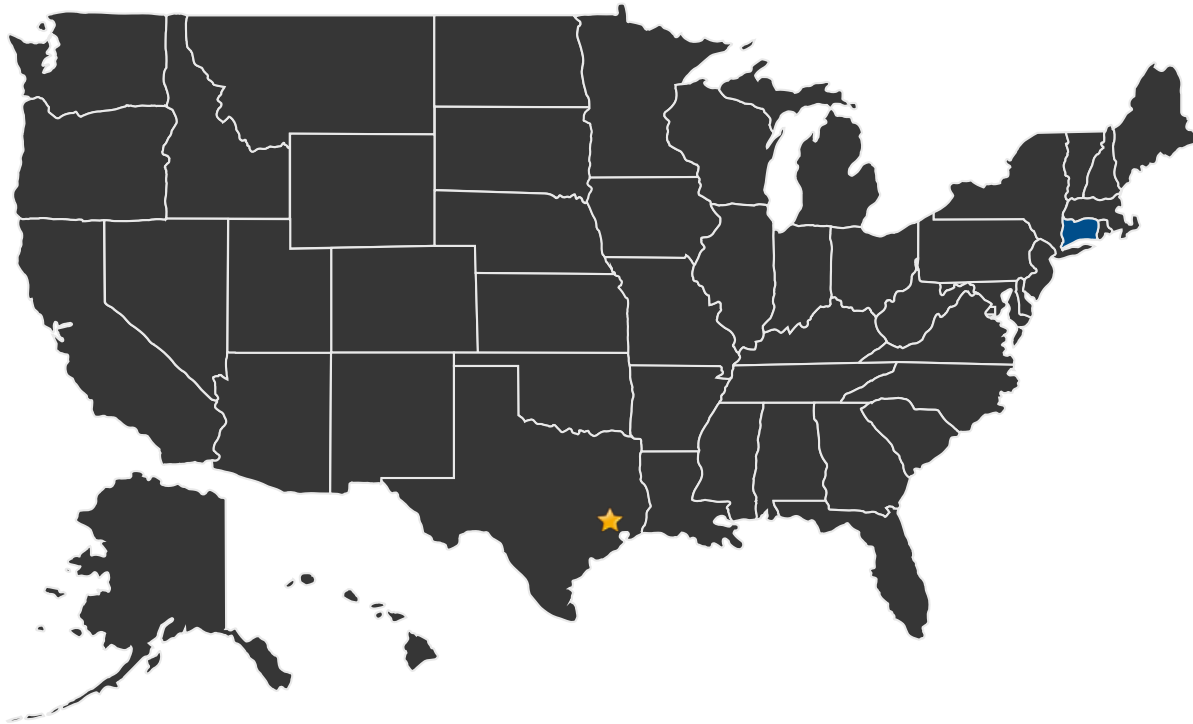
- └ Extravehicular Activity Systems (TA 6.2)
 - └ Pressure Garment (TA 6.2.1)

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U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States With Work ★ **Lead Center:**
Johnson Space Center

Other Organizations Performing Work:

- Air-Lock, Inc. (Milford, CT)

PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23315>)

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IMAGE GALLERY



*Contact Stress Design Parameters for
Titanium Bearings, Phase II*

DETAILS FOR TECHNOLOGY 1

Technology Title

Contact Stress Design Parameters for Titanium Bearings, Phase II

Potential Applications

Air-Lock's core business focuses on providing life support hardware to enhance human performance in hazardous environments. The Titanium bearing design knowledge learned through test and simulation will be used on all suit projects moving forward. Titanium is an excellent candidate bearing race material. It offers lighter weight compared to Stainless Steels commonly used in EVA applications. It offers higher strength Aluminums commonly used in IVA applications. As ever-present budgetary restraints move the industry towards ♦one suit fits all applications♦ approaches. The knowledge and design techniques learned through these efforts will be used in support of all existing and future suit efforts including the current space suit program of record (EMU) and future programs (OCSS and AES) to market the Titanium bearing technology.